8061)

MOREHOUSE

Vol. 65, No. 18, Pages 337 – 344

levels, below the cauldron complex. Epecial features of New Newlec cauldrons include zoned outflow sheets; zoning may be normal (most siliceous at the bottom) or rewarsed. Post-acuption potassium metasometism may mask some chanical trends. The largest rauldrons of southwasters New Mexico tend to occur in clueters, interpreted as surface expressions of buried composite plutons (e.g., Mogolion Flateau). In an early stage of devalopment, or on the frings of a clusior, conditions tend to be asymmetrical trapdoor structures, formed by repeated small pruptions apparated by quiescent periods. During the holght of activity, cauldrons formed by exteresting scuptions, commonly followed by rannegance. The youngest known tauldron is challow and teaulted from asymmetrical subsidence and collapse of calders walls.

J. Caophys. Res., B. Paper 450414

custion isochron represents the locus of poince within a chacker such that begus parcels along a given isochron arrive at the bettee of the volcant conduit concurrently. Open systems evolve towards a time invariant state (fully developed flow). Spin-up time depend on chamber aspect retio (8_f/D_p), reservoir/conduit width ratio (8_f/B_p) and Raynolds number (Re), 8_f, b_f, b_f represent chamber half-width, depth and conduit helf-width, respectively. Spin-up times size small (1/10 to 1/5) fractions of acuption durations. The shape and orienterion of eventual isochrone (El) depend on Re (increasing Re, decreases withdrawal depth) and geometric factors (increasing B_f/B_f at constant Re and B_f/D_f or decreasing B_f/B_f at a constant Re and B_f/D_f or decreasing B_f/B_f). A significant smoont of roofward segme translas untepped in a chamber even for a long duration sruptions driven by either raiders collapse of regime recharge. Relative to the means orcharge (open system) situation, El's are laterally alongsted for calders collapse case. Maximum withdrawal depths very momotonically in both cases. Agreement between the numerical experiments and Fe-Ti onlide temperatures for the Bishop Toff is good.

8699 Voicenology (Voicenology Topice)

SOME MAMERICAL EXPERIMENTS ON THE WITHDRAWAL OF MAGNA
FROM COMSTAL RESERVOIRS

Frank J. Spers (Dept. of Geol. & Goophys., Princeion
University, Princeton, NJ, 08346)
An understanding of the dynamics of magna withdrawol
is assential to reconstruction of intensive veriables
in magna reservoirs. Important parameters governing
the extent of subterranses magna mixing [induced by
withdrawal I molude the wertical structure of donsity
and viscosity, discharge, size and shape of the chember, and vent type. A numerical model to study isoviscous magna withdrawal from a central vent conduit
as a function of the Reynolds number, the reservoir
to conduit width ratio, reservoir sepect vario (width/
depth), and differing kinematic boundary conditions is
presented. Both open (magna recherge) and closed
(colders collapse) systems are considered. Finite
difference solutions to the vorticity transport and
Foisson equations anables determination of vorticity,
stream function, and velocity fields as a function of
time. Output includes stream function (particle trajectorical and avarention isochron diagrams. An ovecuacion isochron tepresents the locus of points within
a chacher each that bagua parcels along a gluon isochron arrive at the bottee of the volcente conduit

8699 Volcanology
INTERNAL GEOLOGY AND EVOLUTION OF THE REDOMNO ODME,
VALUES CALDERA, NEW RESIDO
D. L. Minison and J. B. Hulan (Earth Science Laboratory, University of Utah Remearch Institute, Salt
Lake City, Utah, 34109)
Deep wochermal drilling in the resurgent Redondo
Dome of the Yalins. Calders has allowed us to define a
consistent intra-calders has allowed us to define a
differs in aumber of respects, from the temporally
equivalent sequence of outside the calders. Above the
deeply eroded Pliccene Palize Canyon Forpation, feltic
ash. Flows and sedvents in the down area form a cap
play sequence of updetermined due that we call the
Lower luffs. An erosiopal interval separatas these
rocks, from the overlying Didnit Hember (1.4 m.y.) of

the Bandeliar luff. Another period of erosion, (...)
which a tuffaceuss sandstone was deposited, schröliche Otomi from the overlying lishings member (i.i.
m.y.) of the Bandelier. Both the Otomi and threy
Membors, with maximum thicknesses of 331 m 136.
Membors, with maximum thicknesses of 331 m 136.
Membors, with maximum thicknesses of 331 m 136.
Caldere than outside, indicating similated the calculation of the color o

neutsm
Hydrology
Oceanography
Planetology
Seismology
Seismology
Relationships
Tectonophysics
Volcanology;
Geochemistry,
and Petrology
No section
Friends
Commercial institutions
Totals
Estimated
Investment Income (through
Dec. 31, 1983)
Expenses

Expenses
(through Dec.
31, 1983)
Net Additional

amount (through Dec. I, 1985)

ews

Space Environment Laboratory

The National Oceanic and Atmospheric Administration's (NOAA) Space Environment Laboratory (SEL), along with several other NOAA programs, is slated for a major budget reduction in FY 1985, a reduction which would have a serious impact upon the space environment services now provided by the laboratory.

SEL, jointly with the U.S. Air Force's Air Weather Service, operates the Space Environment Services Center (SESC) in Boulder, Colorado. SESC acquires, in near real-time, world-wide data on solar activity, on the terrestrial magnetic field, and on energetic particles at geostationary and polar orbiting satellite altitudes. Data are available to SESC from solar observatories operated by both the Air Force and a number of nongovernment organizations, the NOAA geostationary and polar orbiting satellites, and a U.S.-Canadian etometer network.

Incoming digital data are processed in a dedicated computer system and displayed at the SESC forecast console where personnel issue forecasts and warnings of significant solar and geomagnetic activity to a wide variety of users. The data are available via computer-tocomputer links, and forecasts and warnings are being distributed without delay using a commercial satellite broadcast system. Additionally, a synopsis of current geomagnetic and solar activity is broadcast on WWV-AM shortwave at 18 min past the hour, and is available via recorded phone message from SESC. Solar-geophysical data summaries are published weekly.

Are You Investing

in AGU's Future?

A tabulation of the various levels of

indicates the number of members who

have been "investing in the future of AGU." More than 6,000 members have

contributed to this appeal. Can you find

your place in the matrix? The members of

the Steering Committee for this program

The major support has come from the Individual Supporting Members and the Life Supporting Members. The lists of

these donors have been increasing each year, almost doubling in number this year. More than 6,000 have now accepted the

"voluntary contribution of \$10" as shown

on the annual dues invoices, and we are

encouraged that so many have done this

for 3 successive years. Those who made

this contribution for the first time this

year should plan ahead. The appeal will continue until 1986.

The record keeping for this financial

campaign would seem to be a natural for the computer, but the system was not de-

28,164 22,251 8,042 17,309

22,679

21,182

18,**29**3 7,719

\$208,746

50,522

\$24,336

1,009 1,201 300 250

2,530

200

are very appreciative of your respon-

and support. We thank each and all of

contribution to the AGU-GIFT program

Editorial

This real-time operation is supported by technique development efforts in SEL's Research Division. The division recently has implemented semi-automatic synoptic mapping of the global solar magnetic fields, as well as statistical maps of the total energy input into the polar region by energetic particle precipitation as measured by instruments aboard the

The Systems Support Division is responsi-ble, along with NOAA's satellite operations element (National Environmental Satellite, Data and Information Service), for the design and procurement of the space environment monitors on the two NOAA satellite systems, GOES and NOAA/TIROS. Recently, the divi sion successfully demonstrated in the laboratory a prototype X ray imager designed to supply real-time X ray images of the sun. It is hoped such operational monitors can be

flown on satellites by the 1990's.

In other developments at SEL, a new data base system, SELDADS 11, has been procured and should be on-line by late 1985. Using a Data General MV10000 computer, the system will enhance SEL's capabilities to store and analyze the real-time data stream and will be able to run improved forecasting models.

The proposed budget reduction will impact upon SEL operations in a number of ways: Supporting technique development efforts for improving services will be lost; the present 24 hours per day forecast/warning schedule will be reduced to an 8 hour per day, 5 days per week operation; support for the satellite systems will be decreased, with the possible loss of the solar X ray imager sys tem; the SELDADS II implementation will be delayed; and, the number of space environment products will be decreased, including a cutback in both the weekly "Preliminary Re-

signed for such an effort. So, the Commit-

words, maintain a record of the individual

investments as best we can at little or no

cost to the investor. We did ask the master

system to produce sets of mailing labels

for the full membership; that is, one set

for each Section. Each computer printout

fold contains 48 of these sticky labels. An

investment record is maintained on a 4" x

6" card, with a pulled label attached for

identification and for alphabetic filing, a file for each Section. A beautiful byprod-

uct of this manual system is the hard copy residue of the unpulled labels (i.e., those

This particular feature—the record of

nonparticipants—gives us much concern. We know that many of the younger members and some of those enjoying retirement are not able to help; however, when

we look at the labels still on the master

printout we see names of many members

who have benefitted and continue to ben-

efit from their membership in AGU. They

are receiving dividends—even compound

membership. For those of you whose la-

bels we have not pulled and are able to

help, we ask that you look again at yout

your role in this program.

A few of our members are employed by

AGU-GIFT Program as of April 16, 1984

relationship with AGU and reconsider

218

528 413

504 180

23,452 8,342

17,559

28,712

18,493 7,719

2,100

ed-by virture of their many years of

who have not been able to invest).

tee has had to improvise, or, in other

December 1984 AGU 2 3 4 5 6 7 9 10 14 12 18 14 15 16 17 18 19 20 21 22 16 17 18 19 20 21 22

NOAA/TIROS satellites. plan to attend

> port and Forecast of Solar Geophysical Data" publication, and the space environment sumies on the WWV broadcasts.

Suggestions

23 24 25 26 27 28 29

attend

30 31_

This news item was contributed by William J. Brennan, Public Affairs Officer, National Ocean-ic and Atmospheric Administration, Environmental Research Laboratories, Boulder, CO 80303. Ocean Drilling

The Ocean Drilling Program replaces the recently completed drilling phase of the Deep Sea Drilling Project (DSDP). A new and larger deep sea drilling vessel with expanded ca-

corporations that practice matching gifts

f their employees. We extend a double

thanks to those members who have asked

tion double matches, so a triple thanks is

due. If you are employed by a corporation

that contributes to educational institutions,

merits support for its program of continu-

Those of us who are U.S. citizens re-

Through the personal deduction process

for contributions-or those "investments

comes a participant in the GIFT program

many of the state governments are also participating. It is simple: The greater your deductions, the greater their partici-

pation. So the bottom line is, What you

invest in AGU" will bring multiple divi-

dends, a greater financial reserve for the

not Paine-Webber.

Union and lower taxes for you. Thank us,

Charles A. Whitten

AGU GIFT Fund

Steering Committee

Co-Chairman

1,094

9.992

with a form of matching. In the same way,

in AGU"-the federal government be-

cently submitted statements to the IRS

identifing dividends and contributions

along with other related information.

their employers to match. One corpora-

endeavor to convince them that AGU

pabilities including a longer drill string, bare rock spudin, enhanced logging, and the po-tential for riser drilling will replace the D/V Glonar Challenger. Drilling is scheduled to commence in January 1985, and planning is now underway for the tentative schedule shown below. The drill ship will then proceed to the Pacific Ocean and circumnavigate the earth at least twice during the 10-year program. Suggestions for drilling objectives, downhole experiments, etc., for all areas worldwide are now being solicited by JOIDES Joint Oceanographic Institutions for Deep Earth Sampling).

Suggestions for use of the drill ship are re-

Fall Meeting

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■ Poster Sessions

ASLO Winter Meeting

Civic Auditorium, San Francisco

For Details See April 24 EOS

viewed by the JOIDES science advisory struc-ture, which includes three thematic and five regional panels and four service panels. The advisory structure is supplemented as required by specialized working groups and task groups. Approved objectives will be inte-grated into the drilling program by the Plan-ning Committee under the direction of the JOIDES Executive Committee.

JOIDES is also seeking persons with scientilic or technical expertise to serve on advisory panels for approximately 2 year terms. Anyone wishing to be considered should send his or her vita to the JOIDES office.

JOIDES is an international organization made up of ten U.S. academic institutions and the science agencies of other member countries which presently include Canada, France, the Federal Republic of Germany, Japan, and the United Kingdom, Support for the Ocean Drilling Program is provided by the U.S. National Science Foundation, the Department of Energy, Mines and Resources of Canada, the Centre National pour l'Exploitation des Oceans of France, the Bundesanstalt für Geowissenschaften und Robstoffe of the Federal Republic of Germany, the Natural Environment Research Council of the United Kingdom, and the European Science Foundation representing Italy, The Netherlands, Norway, Sweden, and Switzerland. Participation in the Ocean Drilling Program and science advisory structure is open to anyone, and is not limited to representatives of JOIDES institutions or member countries. Drilling suggestions and proposals should be submitted to the JOIDES office, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33!49 (telephone: 305-

This news item was submitted by Donald S. Marszalek, JOIDES Science Coordinator, Miami,

Tethered Satellite Opportunity

The National Aeronautics and Space Administration (NASA) and the Piano Spaziale Nazionale of the Consiglio Nazionale Delle Ricerche of Italy (PNS/CNR) are inviting re searchers to participate in the first three flights of the Tethered Satellite System (TSS) on the space shuttle. The Tethered Satellite, a joint Italian/U.S. project, will deploy experiments in space at a distance of up to 100 km from the shuttle orbiter. Science instruments will remain tethered either upward or downward from the vechicle for approximately 16 hours at a time before being "reeled" back in, The first three missions, scheduled between 1987 and 1990, will conduct experiments primarily in the areas of space plasma, atmospheric, geomagnetic, and earth gravity phys-

Letters of intent to submit an investigation are due at NASA or CNR by May 21, 1984. Proposals, including details on investigation and technical plans, management, and cost, are due by July 20, 1984. Those who wish to receive a copy of the full Announcement of Opportunity (A.O. No. OSSA-1-84) should write Robert D. Hudson, Mail Code EE, NASA Headquarters, Washington, DC 20546,

News (cont. on p. 346)

345

Tectonophysics

SISO Plate Vectorics
THE GEOMETRY OF BACKARC TRRUSTING ALONG THE MASTERN
SURDA ANG, DROWESIA: CONSTRAINTS FROM EARTHQUARE AND
GRAVETY DATA
R, MCGETfry (Department of Earth, Atmospheric and
Flanctory Sciences, Messachusetts Institute of
Technology) and J. Nabelek
The Floras verthquake of Detember 23, 1978 represents
the fivet sciencing leaf avidence for active beckare
thrusting behind the sastern Sunda Arc. This my-5.3
earthquake occurred morth of Floras telead where
science reflection profiling has revealed backare
thrusting - interpreted to be a reaction to compression
of the arc following collision with the Americalian
continent. We investigate the source mechanism and
depth of the Flores earthquake by inversion of iong
paried P avenierus and relocate the earthquake's
epicanter incorporating arrival Lina data from local
stations. We find that this swent occurred beneath the
eccretionary prism south of the backare thrust some at
a depth of 11.5 be (7 to below the sea ficor). The
best fitting insit plans solution is consistent with
active southward thrusting of the ficor of the Flores
leain beneath the volcanic arc along a 30 dipping
fault plans. The morphology of the thrust zone and the
free-ing gravity profile over the flores Basin to the
apicantral region resemble those of oceanic tranches
and the observed gravity field is best interpreted if
the creat of the Flores Lacin dips asochly below the
accreted wedge at an average angle of about 6°. The
position of the sarthquake hypocenter south of the
Flores Throat and the Louit plans solution august that
the 1976 earthquake is enalogous to threst events at
subduction comes and represents alig between the
subduction comes and represents alig between the
subducting and overriding plates. The Flores Throat la
thus the sortace expression of a deep seated throat
zone and may represent the initial stage of polarity
reversel of the eastern Senda Arc. (Indowssia,
collision, between the seatern Senda Arc. (Indowssia,

Volcanology

MID-TEXTERY ASK-FLOW TUFF CAULDROWS, SQUIMMESTERN MED MEXICO.

Molfgang P. Elston (Department of Geology, University of New Maxico, Abbuquarque, New Maxico, 2713))

This semmary choracterisms 28 Anova or suapsected mid-Textiary ask-flow tuff (Sgnimbries) cauldroom, up to 40 hm in dissect; in southwastern New Mowico. A combination of poar-guidron bloch functing and erosing has resulted in widely ranging lawels of threa-dissonations appeares, down to plutooic roots. The evolution of the largest raporgant cauldross followed stages determined by other workers for the willes and take City calders, with local variations: i. procursor, 2. calders collapse, 3. early poat-collapse volcasism, 4. major ring-fracture volcantium, and 5. hydrothermal activity. Development can be toradiated at my stage; attage can also be topeated. Resurgent dowing can occur during stage 3 or later; doming dan to stage; attage can also be topeated. Resurgent dowing can occur during stage 3 or later; doming dan to subject to the same may have quite a different configuration. As resurgent dowing my be difficult to recognize in product chaldrons, a preposed modification in the definition of "resurgence" places suphasis of one of saveral effects that may or any set except when magas invades a couldron, introduction for source of the definition of "resurgence" places suphasis of one of saveral effects that may or may set except when magas invades a couldron, in secondary in one of saveral effects that may or may set except when magas invades a couldron, in secondary of the court of the secondary of the saveral effects that may or may set except when magas invades a couldron, in secondary of the saveral effects that may or may set except when magas invades a couldron, in secondary of the saveral effects that may or may set except when magas invades a couldron, in secondary of the saveral effects that may or may set except when magas invades a couldron, in secondary of the saveral effects that may or may set except when magas invades a couldron, in

May 1, 1981

N

AMATITIAN, AN ACTIVELY EXPENSIONS OF GOLDEN and Golden Richard L. Wunderman (Dapt. of Goolen Belevisty, Engineering, Michigan Technological Belevisty, Brighton, MI 49931), W. I. Rose Houghton, MI 49931), W. I. Rose A 14 x 16 km diameter collapse calder has been a 14 x 16 km diameter collapse calder has been as the collapse of the collapse of the collapse calder has been as the co Mewahton, MI 49931, W. I. Rose
A 14 x 15 har dismater collapse enters has been
A 14 x 15 har dismater collapse enters in Contents (IV).
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Guntensia. The caiders is north of the presety
volcano. The caiders was not praviously contents
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pyroclastic rocks. The existence of the sorter
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News (cont. from p. 345)

Solar Max: Three Hits, One Save. . .

In the end it was all smiles and congratulations, but the crew of the space shuttle Challenger and NASA engineers in Houston and at the Goddard Space Flight Center in Greenbelt, Md., were not Torgetting how close the Solar Maximum (Solar Max) satellite repair mission had come to being the Solar Max destruction mission. In fact, if it had not been for a late night resuscitation effort by a team of engineers at Goddard and a particularly providential sunrise, the shuttle crew might never have gotten their hands back on the \$200 million orbiting solar observatory after a docking attempt on the mission's third day knocked it out of kilter. As it is, thanks to the astronauts' skilled repair work, the satellite is now ready for another 6 years or more of sun watching.

Solar Max had been stranded in space since

1980, the victim of blown fuses in its attitude control system that left four of its seven science instruments without accurate pointing capability. Shortly after the blow out, God-dard technicians had put the satellite in a slow, "coning" spin to keep its solar panels pointing at the sun and the batteries charged up. In this holding pattern, turning at the rate of 1° per second, the first satellite designed to be reserviced in orbit had awaited its rescuers for more than 3 years.

Challenger and its repair crew were launched on April 6, 1984. The trouble started two days later, when astronaut George Nelson tried to dock with Solar Max and steady it so that it could be picked up by the shuttle's long mechanical arm. Three times he tried to mate a cylindrical attachment device to a trummion pin protruding from the satellite's midsection, but three times he bonneed away without the device locking (the problem, it now appears, was with a small engineering blueprints).

Surface wave tomography is being used to

map the seismic velocity and anisotropy of the upper mantle on a global basis [Nata] et

al., Anisotropy and shear-velocity heterogene-

ities in the upper mantle, Geophys. Res. Lett., 11, 109-112, 1984].

The color figure shows cross sections of the

upper 670 km of the mantle. (Note previous

Seismic Cross

Sections of the

Upper Mantle

Forum

Child Care at National Meetings

Is your participation in AGU meetings limited by the lack of child care facilities? Would you be willing to pay for such services? The AGU Education and Human Resources Committee surveyed a sample of members, and our findings were inconclusive. If your meeting attendance de-pends on the availability of daycare, please write a brief note to that effect, and send it to the committee at AGU Headquarters
If response to this request is sufficient, this committee will recommend that some action be taken.

> Louise Levien Member, AGU Education and Human Resources Committee

Geophysical Weight Loss Diet

Having for numerous reasons acquired a three digit kilogram mass, the author is experienced at the painful struggles that gourmand must suffer to reduce weight, particularly if he/she enjoys reasonably large amounts of good food. To the avant-garde geophysicist, utilizing the following approach could be pleasurable. Alexander the Great, Napolean, and Hitler could not! The basic approach is the full utilization of Newton's formula for the attraction of

nent of what Ghengis Khan,

2 x 10³⁵

1075

M_z 2 MASS

TIME, WEEKS

side; no need to worry about iron pills.

Week 8, Finally enjoy the culture and food of

the antipodes. As with many diets, there are some side

Week 7. Watch those pounds disappear.

effects. The worst appears that there is

becomes an astronomical gastronomel

nothing left to eat at the end, unless one

Acknowledgement. The benefits of this ap-

proach were discussed with Kwing Chan,

Dick Goldberg, Hans Mayr, and Nathan

Miller et al. during a Chinese New Year's

NASA Goddard Space Flight Center Greenbelt, MD 20771

Kenneth Schatten

Salar Radiation Office

two massive bodies: $F=GM_1M_2I^2$, where G, is the gravitational constant; r, the distance between the two bodies; and M_1 and Mz, the masses of the two bodies. Although one usually chooses M1 to be the earth's mass M_E and M_2 to be the mass of a small object, this unnecessarily restricts the realm of phenomena. The less restrictive assumption is $M_1 + M_2 = M_E$.

Utilizing this latter equation has enabled

rewarding, and may even enable the

the development of the Geophysical Weight Loss Diel. The figure is a plot of the expected weight changes. Do not fear the initial weight gain, for, as the curve shows, a final weight loss is guaranteed!

The Diet:Week 1, Consume herds of cattle. devastate crop fields. Week 2, Pillage viliages, farms, and lay waste

to the countryside. Week 3, Develop a taste for small mountain ranges, gorge your thirst on great lakes. Week 4, Delight on crustal dining, sample the refreshing taste of a small ocean.

Week 5, Enjoy more of the pie, taste the mantle below the crust, nibble on the core for dessert. Week 6, Work your way through to the other

of power, because now that its panels were no predictable tumbling, and came "close, but no longer pointing at the sun, Solar Max's oncigar," according to commander Robert Crippen, before getting word that technicians at Goddard (Solar Max's command center) buboard batteries were draining without recharging. After shutting off all the spacecraft systems they could spare, including the heatlieved they could stop the satellite's rotation ers for the science instruments, the Goddard What followed was a day-long race to get the spacecraft under control before it ran out team activated magnetic torquer bars in the spacecraft that act as a kind of lever against

Up until this time, Solar Max had been turning like a very slow and steady top. Now, because of the docking jolts and Nelson's unsuccesful attempt to steady the satellite by grabbing onto one of its winglike solar panels, it was tumbling more rapidly around all three of its axes. The crew tried to grab the satellite with the shuttle's arm despite the un-

sections for XI, with this interpretation,

would be orange in regions of ascending and

larized shear waves, averaged with respect to azimuth. The orange regions are slow, presumably hot, regions of the mantle, although VSV can be low due to crystal orientation, or anisotropy, as well as to high temperature. The ambiguity is removed by studying the The parameter XI is related to VSH-VSV, the difference in velocity between the two polarizations of shear waves. Olivine crystals oriented with the fast axis in the horizonial plane would give positive XI. This would be the expected situation for horizontal flow. Vertical flow is expected to give negative XI for an olivine-rich mantle. The cross

The cross sections are labeled with the parameters of the great circle, right latitude, longitude, and azimuth. The horizontal line across the center of the map is the great circle of the cross section. The horizontal lines in the cross sections are at depths of 60, 220, and 400 km.

from the ground.

Note the deep, 400 km, slow anomalies un-der the Afar triple junction and the East Pacific Rise. The apparent sources of the midoceanic ridges are often offset from their surface expressions. The fast material at depth under South America, the south Atlantic, and the western Pacific may represent material that cooled at the earth's surface. The threedimensional character of mantle flow is evident when viewing many of these cross sec-

tions. The mid-Atlantic ridge appears to be shallow on these cross sections but can be traced to greater depth in other sections. This suggests that there is large lateral transport of material between source and ridge.

Tomographic research at Caltech is supported by National Science Foundation grants EAR-8115236 and EAR-8317623. I thank Robert Clayton, Bradford Hager, and Adam Dziewonski for assistance in making the illustrations.

This news item and photo was contributed by Don. L. Anderson, Sermological Laboratory, California Institute of Technology, Pasadena, CA



Street Carlot Representation

the earth's magnetic field, a crude form of backup attitude control. At first the engineers thought this was working. Soon, though, it became apparent that the satellite's gyroscopes were being overloaded by the high rates of motion and were not giving the proper information about the spacecraft's poition to the torouer bars.

Once the Goddard team realized this problem, they devised a new plan. By telemetry command, they dumped the satellite's onboard computer and sent up a new attitude control program called "B-Dot" that used magnetometer rather than gyroscope data to sense the spacecraft's position. This trading of programs took nearly 3 hours to complete, but it worked; the torquer bars almost immediately began to steady the satellite.

Now there was a new worry. B-Dot was very good at absorbing momentum, but it didn't allow for any attitude control from the ground. The Goddard team had no way to get the solar panels pointed back at the sun. Meanwhile, the batteries were losing energy with each nightside pass. Finally, drained to about 225 watts of power, Solar Max was not expected to live much longer than one more period of darkness. Ground controllers turned off the satellite's onboard radio transmitter just before it entered eclipse again in a last-gasp attempt to save another 25 watts, and then they waited.

Miraculously, when the spacecraft came into sunlight again, its solar panels were facing the sun enough to begin recharging the batteries. With each succeeding orbital the sun angle got a little better and the batteries a little stronger to the point where ground technicians were able to reload the original computer program, reestablish attitude control, and point the panels toward full sunlight. By morning the power was up to 100%, Solar Max was again turning neatly at the rate of one half a degree per second (slow enough for the shuttle arm to grapple), and the Goddard engineers were able to relax for the first time in what had been a very long 24



The Weekly Newspaper of Geophysics

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Cover. The AGU and its logo are now a part of the Washington skyline and are prominent features on Florida Avenue, N.W., and nearby Connecticut Avenue. Those of you who have been contributing to the future of AGU can now see some tangible evidence of these investments. Of course, the real action is on the inside. If you are in Washington, D.C., and in the neighborhood of the building, come inside, go to the eighth floor, and see the plaque bearing the names of the major contributors to the AGU GIFT Fund. If your name is not on this list, the GIFT Fund Steering Committee would be very pleased to add it. The plaque is a proud lymbol of the esteem AGU elicits from its nembers as is the Headquarters building in which it resides. (Photos by Cynthia Bravo. AGU logo designed by Dae Sung

And 6 More **Years of Science**

After these heroics, the rest of the repair mission went more or less according to the (amended) script. The crew was able to retrieve the satellite, fix its attitude control system and coronagraph/polarimeter instrument as planned, then redeploy Solar Max in its 500-km-high orbit on April 12.

Barely was the satellite back in service again when it got the chance to observe the eruption of a major solar flare, through what Solar Max project scientist Bruce Woodgate calls "a combination of anticipation and rapid re-pointing." The satellite had been near the middle of a 30-day engineering checkout period when, on April 23, the onboard hard X ray burst spectrometer began detecting flare bursts in a particularly active region on the sun. Project scientists then requested Goddard technicians to move the satellite and point its narrow field instruments at the aclive region, with the result that half an hour later the satellite was perfectly positioned to record the largest flare of the current solar cycle occuring on the sun. "We got lucky there," says Woodgate. So interesting were the data returning from this flare region that Solar Max was scheduled to remain in its "science mode" for about 2 weeks before picking

up again with the engineering healthchecks.

Once it returns to full-time science, the satellite is expected to return data until it reenters the atmosphere, probably sometime in 1990 or 1991. Although it was launched pri-marily to study solar flares, in its second incarnation Solar Max will divide its observing time more evenly between flares and other solar phenomena. Prominences-long streamers of mass exploding outward from the sun's limb (edge)—will be studied in a viewing program coordinated with ground observatories in Hawaii, California, and France. The satellite will also continue to monitor the solar constant, or total energy output that reaches earth (which it saw to be declining in 1980). and will take daily or near-daily images of the corona so that scientists can have a record of its changing shape at different periods in the solar cycle

One of the more intriguing problems to be tackled by Solar Max involves the high-energy gamma ray emissions from solar flares seen by the gamma ray spectrometer in 1980. The gamma ray results showed flares with much higher energies and faster "rise times" than had been previously expected. In fact, no current theory of particle acceleration can explain them. Before Solar Max, only lower energy gamma rays with rise times of minutes (as opposed to less than 3 seconds) had been seen streaming from the sun. "We need to work on theories to explain how this energy rise can happen," says Woodgate.

A windfall of Solar Max's revival after 3 years of dormancy is that scientists will now be able to interact more closely with the satellite in real time, thanks to NASA's Tracking and Data Relay Satellite System (TDRSS). The satellite link is expected to allow observers on the ground to change viewing modes or repoint Solar Max instruments in near-immediate response to events happening on the sun, something they could not do in 1980 when the TDRSS wasn't in place. "With a person in the loop," says Woodgate, "we'll be able to do more pattern recognition" of fea-

tures and rapidly occuring events on the sun. The sun is not the only target in Solar Max's viewing plan. When Halley's comet swings around the sun in February 1986, several instruments, including the coronagraph/ polarimeter repaired by the Challenger crew, will return data and visual images of the com-

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et and its attendant tail. Solar Max will observe Halley from early January to late March, both before and after its closest sun

Halley-bound spacecraft will take much closer looks in March, but for a period of about 2 months in early 1986, says Woodgate, "we

approach, at a time when ground observation will be difficult if not impossible. A fleet of	will be the only observatory to observe the comet."—The	
In Congress		
Legislative Update		
ARCTIC RESEARCH AND POLICY ACT, H.R. 2292 (Young, R-Alaska) and S. 373 (Murkowski, R-Alaska), we provide comprehensive national policy dealing with natineeds and objectives in Arctic and would provide a cent system for collection and retrieval of scientific data, estal priorities, and provide financial support for basic and a scientific research.	onal ralized blish	House Passed April 24, 1984
EARTHQUAKE HAZARDS REDUCTION ACT, H.R. (Walgren, D-Pa.) and S. 820 (Gorton, R-Wash.), now pur P.L. 98-241, authorizes \$67 million for fiscal 1984 and a crease for inflation for fiscal 1985. S. 820 passed the Sea April 7, 1983, and passed the House Feb. 1, 1984. Signal aw on March 22, 1984.	blic taw 15% in- nate	P.L. 98-241
EXCLUSIVE ECONOMIC ZONE IMPLEMENTATION H.R. 2061 (Breaux, D-La.) and S. 750 (Stevens, R-Alask would implement 200-mile EEZ adjacent to the U.S. tersea. Would also set forth U.S. policy on development and of the natural resources and ocean floor. H.R. 2061 refe House committees on Foreign Affairs, Interior and Instairs, Merchant Marine and Fisheries, and Ways and Me 750 referred to Senate Committee on Commerce, Scientransportation.	a), scheduled ritorial d use erred to ular Af- eans. S.	Hearings to be scheduled
EXPORT ADMINISTRATION ACT AMENDMENTS, 3231 (Bonker, D-Wash.) and S. 979 (Heinz, R-Pa.), defi strictions on the export of scientific and technical infort House passed its bill Oct. 27, 1983, and sent it to the Se 979 passed the Senate March 1, 1984, and passed the I-March 8, 1984. A conference to iron out the difference held April 12, 1984.	nes re- nation. :nate. S. louse	In conference
LAND REMOTE SENSING COMMERCIALIZATION OF 1984, H.R. 5155 (formerly H.R. 4836) (Fuqua, D-F S. 2292 (Gorton, R-Wash.), aims to establish a system to the use of land remote-sensing satellite data. Assethe private sector is best suited to develop land remote-data markets and that cooperation between the federal ment and the private sector should be initiated now to continuity of data and U.S. leadership in land remote s A fully commercialized system should be phased in gra according to the bill.	a.) and May 8, 1984 pro- rts that sering govern- assure ensing.	Passed April 9, 1984

NATIONAL OCEANIC AND ATMOSPHERIC ADMINIS-Awaiting fur-TRATION ORGANIC ACT, H.R. 3381 (Forsythe, R-N.J.), would establish NOAA as an independent agency and as the agency primarily responsible for providing occanic, coastal, and atmospheric services and supporting research (Eas, Sept. 6, 1983, p. 537). Would also establish procedures to avoid duplication of effort in these fields among government agencies. Re-ferred to two subcommittees of House Merchant Marine and Fisheries Committee and one of House Committee on Science and Technology. Several other bills that would establish a De-partment of Trade also call for making NOAA a separate agency. Merchant Marine Committee reported the bill out of committee April 10, 1984.

NATIONAL OCEANS POLICY COMMISSION ACT OF 1985, H.R. 2853 (W. Jones, D.-N.C.) and S. 1238 (Hollings, D.-S.C.), would establish a 15-member commission that would develop recommendations for Congress and the President on a comprehensive national oceans policy. S. 1238 referred to Senate Commerce, Science, and Transportation Committee. Passed Oct. 31, 1983 PEER REVIEW REAFFIRMATION, H.Con.Res. 257 (Sensen-Awaiting com mittee action

brenner, R-Wisc.), would reaffirm "the commitment of the Congress to award federal funds for scientific research projects and facilities solely on the basis of scientific merit as determined by a peer review process." Follows attempts by several universities to bypass peer review (Eos., January 3, 1984, p. 1). Referred to House Science and Technology Committee. (A rent resolution is used to express principles and policy.) SCIENCE AND MATHEMATICS EDUCATION, H.R. 1810

Passed March 2, 1983 (Perkins, D-Ky.) and S. 1285 (Hatch, R-Utah). H.R. 1310 allo-cated \$425 million for mathematics and science education in fiscal 1984 (Ecs, March 22, 1983, p: 114). Senate bill, which also would authorize \$425 million, was reported out of the Senate Labor and Human Resources Committee May 16, 1983. SEVERE STORMS ADVISORY COMMITTEE ACT, H.R.

Veto overridden March 21, 1984

5207 (Hammerschmidt, R-Ark.), aims to assure that forecast of severe storms within government agencies is coordinated for maximum benefit. Would establish a committee of no more than 12 members that would recommend new programs, assess current forecasting programs, and make recommendations for incorporating new technology developments into the operational forecasting system. Referred to a subcommittee of the House

WATER RESOURCES RESEARCH ACT OF 1984, S. 684 (Abdnor, R-S.Dak.), now public law P.L. 98-242, provides for the establishment of one water resources research and technolthe establishment of one water resources research and technology institute in each state and territory to "plan, conduct, or otherwise arrange for competent research with respect to water resources . . .; promote the dissemination and application of the results of these efforts; and provide for the training of scientists and engineers through such research, investigations, and experiments." Passed the Senate May 25, 1983, and passed the House Oc. 31, 1983, President Reagan vetoed the bill Feb. 21, 1984. The Senate overrode the veto (86 to 12) on March 21, 1984, and the House overrode the veto (309 to 81) Murch 1984.

YEAR OF WATER, S.J. Res. 202 (Armstrong, R-Ohio), would designate 1984 as the Year of Water. Aims to increase awareness and dedication to the interests of worldwide water resources (Bot, March 20, 1984, p. 105). Referred to House Committee on Post Office on Post Office and Civil Service. Passed Feb. 27, 1984

For additional information, contact the sponsoring Member of Congress or committee indicated. All congressional and committee offices may be reached by telephoning 202-224-3121. For guidelines on writing to a member of Congress, refer to AGU's Guide to Legislative Information and Contacts (Eas, April 17, 1984, p. 159). The last Legislative Update was published in the January 24 Eas.—BTR.

Veto overrid-

No companion resolution

den March 22.

Ground Water Monitoring Technology: Procedures, Equipment, and Applications

Robert D. Morrison, Timeo Mfg., Inc., Prairie du Sac, Wis., xv + 111 pp., 1985, \$93.

Reviewed by Kenneth R. Bradbury

Over the past few years, increased interest in groundwater monitoring has resulted in numerous new articles about, equipment for, and approaches to the field measurement of physical and chemical groundwater parameters. Ground Water Monitoring Technology is a useful book that attempts to make sense of this recent information by organizing it into sections on monitoring the vadose zone (part 1), monitoring the zone of saturation (part 2), and groundwater sampling equipment (part 3). According to the preface, "A degree of discrimination was exercised in selecting technologies which were directly applicable for field use." The book emphasizes "field prov-en methods which have been documented" at the expense of other promising but unproven field techniques, and it omits laboratory methods except where required for instrument calibration. Morrison is aware of the rapidly changing nature of current groundwater field techniques and has written the book so that it "will be useful even after a particular instrument becomes obsolete."

Ground Water Monitoring Technology is not a "cookbook" of step-by-step instructions for field investigations, nor is it a collection of case studies. Instead, it is a compilation of various field methods, each carefully documented by references to the literature, with the emphasis on equipment rather than technique. In fact, the strength of this book is the collection of 481 references, which refer to monographs and periodicals in a number of associated wientific helds, primarily includ-ing, but not limited to, hydrogeology, hydrology, geophysics, soil science, engineering, and meteorology. These references alone are probably worth the price of the book. For each technique discussed, the author briefly describes the theory and equipment involved. The interested reader can then go to the refcrences cited to obtain more detailed information about a particular method or item of

Part 1 of the book, dealing with monitoring in the vadose zone (55 pages; 380 references) is excellent in scope and detail, and many readers may want to purchase the book solely

tential, soil moisture content, soil salinity, temperature, and soil pore water sampli provide a good review of "traditional" techniques such as tensiometry, moisture blocks, electrical conductivity probes, and vacuum pressure lysimeters, while introducing newer techniques such as Nuclear Magnetic Resonance and incluctive electromagnetism, which may be unfamiliar to many readers. Professionals involved in contaminant monitoring will be particularly interested in the section on soil pore water sampling, which discusses how various lysimeter materials (ceramics, nylon, fritted glass, Tellon) can affect the quali-

ty of water samples. Part 2 addresses monitoring in the saturaled zone (14 pages; 64 references), and includes sections on drainage systems, trench and caisson lysimeters, monitoring wells, well points, well clusters, multilevel samplers, hy-brid well systems (a combination of saturated and unsaturated zone monitoring), and piezometers. The strength of part 2 is its emphasis on new monitoring techniques, such as various multilevel samplers. The chapter is less adequate in its coverage of hydraulic head measurements, devoting only two pages and eight references to piezometers and containing essentially no discussion of the precision and accuracy of various water level measurement techniques. In view of the extensive discussion of head measurement in the unsaturated zone and the importance of hydraulic head as the fundamental measurement in hydrogeology, these are curious omissions. In addition, there is no discussion of the applications of the various analog and digital water level recorders available today and which are often integral components of a groundwater

monitoring program.

The third part of the book contains a brief but adequate (10 pages; 37 references) discussion of water sampling equipment, includ-ing bailers, various suction and submersible pumps, and packer pumps. Once again there s an emphasis on how various sampler materials (PVC, stainless steel, Teflon, etc.) can affect water sampling results. The chapter could have been improved by including one or more tables summarizing the adequacy of materials and techniques for sampling various organic and inorganic chemical constitu-

Consultants and researchers involved in groundwater contamination studies will find this book valuable. Most of the equipment described is best suited to relatively shallow investigations (on the order of a few hundred feet or less) and there is a strong emphasis on contaminant studies. Investigators interested in monitoring deeper groundwater systems or in water quantity studies may find the book less useful. The book is clearly written

and well illustrated with legible drawings and

Important Professional Reading...

Ninth International Congress of Carboniferous Stratigraphy and Geology

Volume 1: Official Reports

Edited by MACKENZIE GORDON, Jr. This was the first Congress to be held in the United States and it attracted more than 900 geologists from 29 countries. Highlights of this volume include a special lecture on the Carboniferous of China, a concise summary of the tectonic evolution of the Iberian massif, a short history of the founding of the Carboniferous System, an incisive look at world energy prospects for the next two decades, an outline of the geology of the Spanish Carboniferous coalfields, and a novel treatment of detail paleobotanical comparisons between west European coal basins and the Donetz basin.

High Sulphur Coal Exports

An International Analysis

Edited by MICHAEL M. CROW. Preface by SENATOR CHARLES PERCY and REPRESENTATIVE PAUL SIMON. The papers in this book were generated by the proceedings of the United States Senate Field Hearing and High Sulphur Coal Export Conference held in June of 1981. \$30.00

Blast Vibration Analysis

By G. A. BOLLINGER. This volume synthesizes theory and literature from seismological, geophysical, and engineering fields pertinent to blast vibrations induced by mining, quarrying, and engineering operations. \$6.95 paper

SOUTHERN ILLINOIS UNIVERSITY PRESS RO. Box 3697, Carbondale, Illinois 62902-3697

photographs. A glossary provides definitions of most technical terms used in the book, although a few, such as "cartesian monostat." and, surprisingly, "monitoring," are omitted. Although the publishing company (Timco) is in the business of selling groundwater monitoring equipment this book thankfully does

not promote Timeo products over the products of other firms.

Kenneth R. Bradbury is with the Wisconsin Grological and Natural History Survey, Madison, WI 53706.

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Postdoctoral Fellow in Atmospheric Science. A position will be available beginning October 1, 1984, at the Harvard-Smithsonian Center for Astrophysics for theoretical analysis of the Shuttle glow and studies of upper aumosphere physics and chemistry. A Ph.D., which involved research in aeronomy, is required. Send applications and names of three references to: A. Dalgarno, Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138.

Metamorphic Petrologist/University of New Brunswick. The Department of Geology invites applications for a tenure track faculty position in metamorphic petrology at the assistant professor level. We are seeking a field-oriented petrologist with microprobe experience to compliment our existing programs in petrology and tectonics. The successful candidate is expected to participate in all aspects of teaching and advising at the graduate and undergraduate level as well as maintaining an active research program.

graduate level as search program.

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fraction and Ruorescence utilts and an automated atomic absorption spectrophotometer. Other analytical services are available on campus including transmission and scanning electron microscopy units.

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Technical Specialist in Seismology. The Geophysics Group of the Department of Earth and
Space Sciences, State University of New York at
Stony Brook is seeking candidates for the position
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Ph.D.-Geochemist/Hydrogeologist. Research Planning Institute, Inc., a growing scientific consulting rompany, will hire a geochemist/hydrogeologist to work on terrestrial and marine poliution projects staring 15 May 1984. Necessary skillst include strong field experience as well as knowledge of organic and metallic pollutants. Experience in pollutant transport modeling highly desirable. Good communication skills imperative. Send resume and examples of previous work, published papers, and so forth, to:

Jacqueline Michel, Ph.D. esearch Planning Institute, Inc. 925 Gervals Street Columbia, SC 99201

Postdoctoral Research Associate Positions/Geophysics and Igneous Geochemistry. The University of Maine at Orono (UMO) has postdoctoral openings for a solid earth geophysicist and an igneous geochemist. We seek a geophysicist and an igneous geochemist. We seek a geophysicist who wishes to advance fundamental understanding of past and current thermal histories of the Appalachlan Orogen in New England and elaewhere. The geochemist would be expected to investigate volcanic and plutonic suites in the Appalachians in Maine and in other terranes. Current funding permits appointments for at least 12 months. Subject to arrival of anticipated funding, the appointments could be extended to two years. Both appointments could be extended to two years. Both appointments could start as early as August 1, 1984. Excellent facilities for geothermal research, computer applications, petrologic research and geochronologic studies exist at UMO. Additionally, limited funds are available for travel and research, and the appointees will be encouraged to generate exterior support individually or through cooperation with existing faculty. Please send inquiries, a vita, a list of referees, and a description of research interests to Edward R. Decker or Daniel R. Lux, Department of Geological Sciences, 110 Boardman Hall, University of Maine at Orono, Orono, Maine 04469. Telephone calls may be made to 207-581-2152, and forwarded to Decker or Lux.

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The Geochemical and Environmental Research Group in the Department of Oceanography has positions available in organic and isotope geochemistry. Ph.D. level personnel are primarily needed to conduct petroleum-related research. However, applicants with backgrounds in chemical oceanography or environmental chemistry will also be considered. One position involves management and maintenance of our stable isotope laboratory which handles a variety of oil, gas, source rock, sediment, and biological samples for both research and service projects. Other research positions are available in organic geochemistry including projects with diverse funding such as a large multi-year oil company supported consortium research effort and NSF, ONR, DOE, and NOAA, grants. Experience in either GC/MS, Rock-Eval), stable isotope, and/or GC instrumentation techniques (FID, PPD detection) are preferred. Self-motivated Individuals with supervisory skills, an interest in organic geochemical research and the ability to direct and propose original research ideas are invited to apply for these positions. These positions may filled either as permanent research staff or pottoloctoral positions. Positions are available immediately at competitive salaries based on experience and background.

Application should include a letter of application, resume, three references, and selected publications.

if available. Apply to either Dr. James M. Brods of Dr. Mahlon C. Kennik utt H. Department of Ocean-ography, Texas A&M University, College Station, Texas 77843. Texas A&M University is an equal opportunity^{al} firmative action curployer.

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of Michigan for a qualified candidate with a Ph.D. degree and experience in Upper Atmosphere Physics. The position involves the analysis of data obtained from two instruments flown on the NASA Dynamics Explorer-2 satellite. The extensive satellite data base provides detailed information of the Dynamics, Thermodynamics and Compositional Structure of the Neutral Upper Atmosphere. The appointment will be for one year trenewable) and is to start in October, 1984. The applicant should identify and describe areas of pipilicant should identify and describe areas of pipilicant should lidentify and describe areas of pipilicant should

that can support theoretical investigations in Upper Atmosphere Physics. A resume and the names of three persons knowledgable of the applicant's expe-rience should be forwarded to: Dr. T.L. Killeen

Dr. T.L. Killeen
Space Physics Research Lab.
Department of Atmospheric and Oceanic Sciences
The University of Michigan
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Ann Arbor, MI 48109–2143
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54-918, M.I.T.
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J.T. Karaku Assistant to the Director

Haystack Observatory Westford, MA 01886.

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ictionophysics, internal earth structure, general geophysics. Geophysics maintains dose contacts with the Ocean Drilling Program and intends to participate actively in the Continental Scientific Drilling Program. The Department has a VAX 11/780 computer and has just moved hub a new building.

Applicants should send their resume and the Appacaus smoute send their resume and the names of three references by June 1, 1984 to E. Hoskins, Department of Geophysics, Texas A&M University, College Station, TX 77843.

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D.G. Torr

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Knowille, TN 37946
We'll be at the AGU Meeting in Cincinnati. Contact I. A. Tashot of T. I. Labotha

Faculty Position in Geophysics. Texas A&M University has a tenure track assistant professor position open starting in the fall of 1984. This is a new position and we will consider applications from outstanding candidates in any area of solid carth geophysics. Preference, however, will be given to cardidates with backgrounds and interests in exploration geophysics, particularly in electrical and magnetic methods. The Department of Geophysics at Texas A&M currently has 17 faculty, 65 graduate students and 100 undergraduate students. The current faculty research cuphasis is in the following areas: exploration geophysics, engineering geophysics, lectonophysics, internal earth structure, geodynamic, and general geophysics. Geophysics maintains Assistant Curator/Texas A&M
University. Assistant Curator, Ocean Drilling Program, Texas A&M University, to oversee operations of ODP core repositionies, including calaloging and maintenance of collections, supervision of personnel, processing of sample requests according to OODES/ODP sampling policy, and participation in drilling emises. Masters or PhD in sedimentology, paleontology, or related area preferred. Send letter of application, resume and names of four referees to:

10: Dr. Russell Merrill, Curator and Manager of Science Services, Ocean Drilling Program P.O. Drawer CK College Station, Texas 77843 Application Deatline is June 1, 1984.

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The Laboratory for Atmospheric and Space Physics of the University of Colorado invites applications for the position of Research Associate, We anticipate openings in active space research programs in the disciplines of planetary atmospheres (including earth's atmosphere and comets), solar physics and astrophysics. LASP facilities include the operations control and data analysis center for the Solar Mesophere Explorer; an IUE Regional Data Center; and a complete space instrument design and fabrication facility. LASP also has experiments on Pioneer Venus, Voyager, Galileo and the Upper Atmosphere Research Satellite. In addition, five sounding rocket experiments will be conducted in 1984 and several of these will evolve to shurtle SPARTAN payloads over the next few years. LASP engineering facilities allow the in-house design, fabrication and calibration of state of the art flight hardware and our modern computer facilities are tailored to actentific data analysis and theoretical studies. The Laboratory is an institute of the University's graduate school and has close ties with the Departments of Astrophysical, Planetary and Aunospheric Sciences and of Aerospace Engineering. A doctorate in a relevant subject is required; salary in accord with experience.

Send leuers of application with an updated resu-Geoscience Data Manager and Staff/Toxas A&M University. Geoscience Data Manager and Staff, Ocean Drilling Program, Texas A&M University, to assemble and monitor all of the electronic lilm and paper data collections produced on the drilling vessel and during subsequent shore studies, including quality control, preparation of data syntheses and documentation, response to user requests, and supocumentation, preparation of data syntheses and sup-port of research activities. Geoscience bachelors or masters degree required. Experience in data base operations desirable. Total of three positions to be filled. Send a letter of application, resume, names of four referees, and other relevant information to: Dr. Russell Merrill, Curator and Manager of Science Services Utah State University/Postdoctoral Position. One postdoctoral position is available in the Department of Physics and the Center for Atmospheric and of Physics and the Center for Atmospheric and Space Sciences at Utah State University. Candidates should have a Ph.D. degree in theoretical and/or experimental aeronomy/space physics. Experience in the following areas will be advantageous: experimental optical spectroscopy, theoretical modelling of the chemistry and dynamics of the atraiosphere/mesophere; theoretical modelling of the thermosphere/mosphere; theoretical modelling of the thermosphere in stratospheric balloon, Space Shuttle and satellite flights, in the design and fabrication of experiments, and in data analysis and theoretical modelling. A comprehensive database of terrestrial emissions covering the extreme ultraviolet to the near infrared, and extending from the surface of the earth to the thermosphere, was recently acquired on Spacelab 1, providing significant data analysis opportunities. The group is also involved in the development of comprehensive models of the photochemistry and dynamics of the thermosphere/plasmasphere. It is planned to extend the modelling weather that the tender to the careful and the modelling weather the late to the careful and the modelling weather to the surface.

rience.
Send letters of application with an updated resume and the names of two references to:
A.I.F. Stewart
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L.A.S.P. Campus Box B-10 Boulder, GO 80301

Applications are being accepted on a continuing basis.

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Research Associate/Research Technician. The University of Maine at Orono (UMO) has an opening for a research associate/research technician who would work in a small geophysical group. We seek an individual who can use and maintain modern digital electronic equipment; for example, multichannel analysers. 10 interfaces for microcomputers, digital plotters and digitaling tablets. Familiarity with BASIC and FORTRAN will be needed, and some geophysical field work may be required as ers, digital potters and taguate be needed, and some geophysical field work may be required as part of the duties of the appointee. Current funding permits an appointment for at least 12 months. Subject to arrival of anticipated funding, the appointment period could be extended to two years, or longer. Call Edward R. Decker at 207-581-2158 or 207-581-2152 about the position. Otherwise, send inquiries, a vita and a list of at least three references to Edward R. Decker, Department of Geological Sciences, 110 Boardman. Hall, University of Maine at Orono, Orono, ME 04-168.

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> The Dean, College of Science, P.O. Box 2455 King Saud University, Riyadh, Saudi Arabia

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Special Doctoral Rescorch Asalstantships. The Department of Oceanography of Old Borninion University has several special doctoral research assistantships available for Fall Semester, 1984 and 1985. These carry a stipent of \$7,000 per academic year, renewable for three years. Applicants with M.S. degrees qualify for waiver of tuition. Students interested in obtaining the Ph.D. in the areas of biological, chemical, geological, or physical oceanography should send an introductory resume to Dr. Ronald E. Johnson, Graduate Program Director, Department of Cecanography, Old Dominion University, Norfolk, VA 23508.

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Optical Aeronomy Workshop II

The second annual workshop on ground-based optical acronomy will be held in Ann Arbor, Michigan, this sum-mer on 20-22 June, 1984. Two topics, ontical detector technology and possible ways and means for improved applications of theoretical models, will be the central issues of this meeting. A total of 11 invited papers covering various types of optical detectors and their applications will be presented on the 20th, and similarly, another set of 10 to 12 invited papers on theoretical topics will be given on the 21st. There will be adequate time provided for discussion throughout the two sessions. These two areas will be reviewed by panel discussions on the morning of June 22. Some travel support will be available. Please write to Mrs. Joan Eadie, University Extension Service, University of Michigan, Ann Arbor, Michigan 48109, for

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Meetings

Announcements

Nuclear Waste Management

November 26-29, 1984 Symposium on the Scientific Basis for Nuclear Waste Management, Boston, Mass. Sponsor: Materials Research Society. (John Stone, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, SC 29808.)

Abstracts for contributed papers are due June 15, 1984.

The symposium on nuclear waste management is one of 17 that will take place at the Fall Meeting of the Materials Research Society. A program of one- and two-day short

courses will complement the science and technology presented in these symposia.

Landslide and Flash Flood Hazards

June 14-15, 1984 Conference on Delinea-tion of Landslide, Flash Flood, and Debris Flow Hazards in Utah, Logan, Utah. Sponsors: Utah Water Research Laboratory, Utah State Univ., Utah Geological and Mineral Survey, National Research Council Committee on Natural Disasters, and Utah Science and Technology Council. (David Bowles, Utah Water Research Laboratory, Utah State University, UMC 82, Logan, UT 84522.)

This specialty conference is intended to assemble descriptive information about land-

slides and debris flows in Utah that caused more than \$250 million worth of damages in the spring of 1983 alone. The conference is a forum for scientists and engineers to exchange data so that they may be better prepared for these destructive events in the fi

Papers will be presented during the confer ence on quantitative methods for mapping flood, debris, and landslide risks below mountain slopes, and on monitoring programs and warning systems for these hazards Specific topics to be discussed include: soil and water conditions that lead to landslides and debris flows, instrumentation for hazard monitoring, damage analysis and cleanup, land use in hazard areas, frequency analysis of debris flow events, and social, political, and legal aspects of emergency and remedial pro-

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Mineralogy, Petrology, and Crystal Chemistry

1260 Paragonamia, patrography, and patrogenesis PRAST COMPOSITION AS A MEASURE OF REACTION PROCRESS AND

PASS CHOUSTION AS A MEASURE OF REACTION PROCRESS AND AS EXPERIENTAL MODEL FOR THE MIGHT-EMPERATURE NETWINDERS OF REACTION PROCRESS AND AS EXPERIENTAL MODEL FOR THE MIGHT-EMPERATURE NETWINDERS OF A STATE OF THE PROCESS.

J. N. FETTY (Department of Geology, Arizons State University, Tempe, Arizons 65287)

A general method is presented by which the composition of phases in meatmorphosed mafis ignaous rocks can be used to quantitatively measure the programs of bineral-finid reactions which proceeded during menamorphism. The method is applied to the experimental hydrothermal phase equilibrium actudy of a mid-ocean ridge tholetite by Spar (1981), and methomorphism of mafic rock by a variety of processes is modelled at temperatures between 500° and 900°C; (a) isobaric context methomorphism with increasing pressure at buffered oxygen fugacity; (c) mereorphism along a "normal" and a "low" goothermal gradient at buffered oxygen fugacity; (d) isochermal, isobaric contextion; and (a) isobaric oxidation with increasing temperature. The model methomorphic events are characterized in terms of (1) overall prograde minoral-fluid reactions; (2) rock modes; (3) changes in rock volume; (4) identity and amounts of volactia species evolved and consumed; (3) amount of P-V work performed by rock on its surroundings or vice verse; (5) amount of bast absorbed or released by rock; and (7) the intersotion of rock with atternal filluid reservoits during progress of the reactions. Two results are unexpocted. First, hatamorphism with increasing temperature at oxygen fugacity controlled by the quarta-fayalita-magnetite (970) buffer involves reduction of rock as minoral-fluid areactions consume fix and rock is neither reduced our oxidized with increasing temperature at oxygen fugacity controlled by the quarta-fayalita-magnetic (1900 buffer is sufficiantly mail that rock is neither reduced our oxidized with increasing temperature. Second, rodal calculations indicate that ar least 14-21 rock valumes Hyo are required to caldire mafte rock from co

Oceanography

atom opinodes, were and current data were also seconded from a dense array of instruments slong a transact across the sour rose.

A statistical analysis of the deep water data was performed, and histograms of impaorological parameters, wave parameters, and water level slope were plotted as a function of wind direction. The atrospheric boundary layer was manually unstable; on the awrage, the water was 2-3°C warmet than the sit. This was true for all wind directions. At the towar, the highest wave were also esseciated with the greatest itch distances to the USW and USW ciractions. At the towar, the highest wave were also esseciated with the greatest itch distances to the USW and USW ciractions. The longest period waves were also esseciated with the speciate the sons wind direction. This distances to the USW and USW ciractions till the sons wind direction. This distances is the variation of currents with wind direction was also examined. The currents are strongest when the winds are from the west—the quidrant with the strongest wind appea. However, there are strong currents (5-10 cm/s) for all wind directions. The deep water currents are beautify whose pereliel, with the onshore/offshore component.

Analysis of the four storm episodes reveals the inclusion of the off-shore currents on the :loy regime within the surf wome. Punctifactive estimates of its longahore manual bullence outside the surf sons show wind sirens and pressure gradient cause. In between thore is avidence of longahors flow reversels in the brasier sons and the effect of seicho-induced offshore currents on the neareshore flow regime. J. Geophys. Res., C, Paper 400624

hill Chemical oceanography (carbon dioxide).
The Indrease in Oceanic Carbon Boiride And The Het
CO2-Flur Into The Morth Atlanic
M. Roos (Institut für Metcorologie und Geophysik der
J.W. Ocathe-Universität, Foldbergeir-17, D 6000 Frankfurt
FF00) and O.Gravahorat
Existing data of pCO2-values and CO2-miring ratios
on the Borth Atlantic are supplemented by CO2-measuremeats made during a cruise of R.W. METEOR on the Morth
Atlantic between 15% and 50%. The seawater was found
to be undersaturated with respect to atmospheric CO2.
pCO2-measurements made at similar geographical locations
but in different years are occapted. The sore recent
pCO2-values are always higher than the cider ones. From
21 data pairs a long-term pCO2-intense over the last
7 decades could be deduced. It falls in the range betveen 0.1 to 1.9 ppm/s depending on whether or what
corrections are applied to the original measurements.
It seems, therefore, that the atmospheric CO2-mining
ratio and the pCO2-value in the surface water of the
Borth Atlantic increased in a similar way.
pCO2-differences across the air-sea interface measured
in different years could, therefore, be grouped into
a unified picture. From it an angual not CO2-rlux
into the Borth Atlantic was deduced according to the
atagmant boundary film model. It amounts to 160 Tg C/a
between the equator and ko9M and to k90 Tg C/a north
of k0°M. The total not CO2-uptake of the Borth Atlantic
or ca 610 Tg C/a borresponds to ga 13% of the presenc
global Industrial CO2-emission into the atmosphere.
(Forth Atlantic, carden diovide increase, CO2-uptake). global industrial CO2-emission into the becomposes. (North Atlantic, carbon dioxide increase, CO2-uptake J. Geophys. Res., C, Paper 400437

4755 Returnius and bays
THE DINAMICS OF A RIVER-BAY-DELTA SYSTEM
Flore Chu Mang (legarthourh of Marine Sciences, Lodislane
State University, Baton Pouce, Louislane 70503)
An analysis has been made to all our understanding of
various phenocuna especiated with turbulant plane jets
that issue from river outlets and discharge into
quiescent bays. An integrated form of the bydrodynamic
type 15th of 15th outlingth on machine with 15th outlingth.

quiescent bays. An integrated form of the hydrodynamic equation of the extension of the state of coupled with advective-diffusion mass transport equation has been formulated into a two-directional partial stemain. Closed-form analytical solutions are obtained with the aid of similarity functions for the velocity and sediment concentration profiles.

A materical procedure for estimating the areal and column deposition of the delta sediments is presented. The Atchafalaya River Delta, a newly developing delta in the south-central touisians Ceast, is used to illustrate ensiytical techniques. The results of analytical gradictions are congared with the results predicted by other statistical and generic approaches, an agreement is found. A sensitivity mealysis is performed to assess the relative laportance of various parameters in the river-bey-delta system. (Rivers,

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Particles and Fields—

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It. Ruth Jackson, G. Leonard Johnson, Etrik Sundvor, and Annik M. Mahre

It. Ruth Jackson, G. Leonard Johnson, Etrik Sundvor, and Annik M. Mahre

Thomas L. Wright

Geologic map of the Rio Grande Rift and Southeastern Colorado Plateau, New Mexico, and Arizona (1983) by W. S. Baldridge, Y. Bartov, and A. Kron ំនៅ លើបទៅទាម មានបំណាក់ បើជាសមាជាធិបានប្រហែល កែបានប្រជាធិបានបំពាល់ ាស្រ្ត នៅជាម្ចាស់មាលស្រាស់ពីស្រីស្រីសេកវិទ 30% DISCOUNT TO AGU MEMBERS

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D. Burgess and S. J. Schwartz (Department of Applied Rathematics, Queen Mary College, Rile End Road, London Rides, England)

Gaing test particle trajectories in a simplified model of a supercritical, oblique, collisionises shock we investigate the interaction of scler wind thermal loss with the setth's bow shock. We present results for shocks with shock angle (Pan) between 35° and 60° and

Oceanography

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409 Sondary layer and exchange processes

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Origin of Hawailan Tholeitic: A Metasomatic Model (Paper 3B153)

Thomas L. Vright

T

ions with the seth's bow shock. We present results for shocks with shock angle (0gm; between 15° and 60° and show that the desirties of the reflected ions and their velocity space signatures are consistent with characterisms of many upstress ion events, particularly grating ions and field-aligned ion beams. The shock is modelled as a finite, planar discontinuity in the magnetic field and in the sleckrostatic potential, which is also given an overshoot at the shock. We find that the shock can produce backstreaming ions by reflecting a small fraction of the incident distribution. The density of these reflected ions depends on the temperature of the distribution, the strength of the shock wie the potential jump, and the specastry of the shock wie the potential jump, and the

STOS Now shock waves
ON THE EXCITATION RECKANISM OF THE LOW FRIQUENCY
UPSTREAM WAVES
Y. Waranaba and T. Terasava (ISAS, Somita, Reguro,
Tokyo, 153, Japan)
The ancitation mechanism of the upstress low frequency
waves (0.01-0.05 Er) is investigated based on the wave
chastyrations. We compared the observed wave fraquencies
with the frequencies experted from the Low (proton)
have writered leave the compared the same of the compared the beam-cyclotron instability. For the waves observed in the deep foresheck region, however, we found it necessary to include the soler wind convection effect J. Gaophys. Sec., A. Paper 4A0573

5730 Hagnetic Coordinate Systems
TEMPORAL MARIATIONS IN THE SIPLE STATION CONJUGATE AREA
E. G. Stassinopoulou (MASA Goddard Space Flight Center,
Breenbelt, Maryland 20771), L. J. Lanzerotti and
T. J. Rosenberg
The Siple Station conjugate locations in the morthern
Amelichare are examined for the epoch 1975-1990 accord-The Siple station conjugate locations in the northern hamisphere are examined for the epoch 1915-1990 according to the predictions of three internal source geomagnetic field models (1817-80, MASAI-80, Barraclough-75) and one external field model (Masd-Fairfield) under quiet and disturbed conditions. The conjugate location systematically changes in the internal studied, making it imperative that changes be add in the locations of the northern hemisphere geophysical stations during the re-activation of Siple Station in 1985-1987.

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HIGH ALTERODE GASERYATIONS OF AN INTERES INVERTED-V NEXTY

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Frank, and Y. E. Esatmen
Inverted-V events which generally occur in the pre-

Inverted-V events which generally occur in the premidelight sector over the surveal sone are frequently
associated with reversals in the convention electric
field. Buch a reversal is observed by the University
of Now quadrispherical LEFORA on beard 18Et-1 at an
elitude of 13 Mg on 1 May 1978. The bull flow of
the plasma mbone a large chear over a five-simute interval. The suscelated change in the convequion
electric field is 3.1 mV m⁻¹. Large values of the
field-eligoned current and electrocounty detected.
The potential structure appears to entend to the satelific location. Using a theoretical model we have
cliculated the field-eligned current doe to the electic field discontinuity. The negations of the permin agree well with obsoryation.
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